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The Whereabouts of Salvadori's Bird Collections

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SUMMARY

Among the Italian naturalists of the 19th century who studied local and exotic avifaunas, Count Tommaso SALVADORI (1835-1923) stands out as one of the most celebrated ornithologists in Italy and abroad. Owing to his vast knowledge of ornithology and to his untiring activity in the study of museum material, the production of SALVADORI as a scientific author is indeed remarkable: approximately 350 publications, including the famous „Ornitologia della Papuasia e delle Molucche" in three volumes and three supplements.

Many Museums of Natural History and private collectors entrusted him with series of birds, obtained from the exploration of little known countries, to be described. Therefore he soon became an expert on the birds of New Guinea, Moluccas, Indonesia, East Asia, Korea, Central and East Africa, Bolivia, Ecuador, Argentina, the North Pole, as well as Italy. A considerable achievement was also the compilation of three volumes of the „Catalogue of Birds in the collection of the British Museum" (dealing with Parrots, Pigeons, Ducks, Flamingos, Tinamous and Ratites), with accurate descriptions of the rich collections then preserved in London, and now at Tring. The finest specimens in the series studied in Italy by SALVADORI are still preserved in the Museums of Genoa, Turin and, at a lesser extent, Milan and Florence, including the majority of the types of his new taxa.

The richness in exotic birds preserved in Genoa Museum is due to the activity of its founder and director Marquis Giacomo DORIA who financed several naturalistic expeditions in which ornithological series were particularly sought after. SALVADORI as deputy director of the Zoological Museum of Turin University was the only one entrusted with the study of all the birds brought back to Genoa Museum and his work was rewarded with duplicates of the skins, also including some syntypes, for the Turin Museum. After the relevant papers were published, part of the studied collections was often broken up by the owners and part of them was sold or exchanged with other institutions. Some important material was unfortunately destroyed (e.g. most of the Turati collection in Milan Museum, some specimens in Lisbon and Dresden Museums), while several series were actually dispersed and scattered as single specimens in other Museums (Palermo, Parma, Pavia, Pisa, Rome, Verona, Leiden, Rothschild collection, now in New York).

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A Relational Database as a Tool in Ornithological Taxonomy and Comparative Systematics

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Abstract. Computer programs that store information on historical and current taxa names are called 'taxonomic referentials'. I created such a taxonomic referential for the class of birds (Aves) in the form of a relational database using the software 4D (www.4d.fr).

About 40,000 original designations of species and subspecies of birds, which were supposed new to science at the time of publishing, have been entered into the database so far. The designations of approx 2,000 authors were compiled using about c. 1,400 different books or journals. All these Linnean bi- or tri-nomina are combined with approx 7,000 genera names, which are themselves published with their own descriptions and, however not always, with a proper designation of their type species.

All genera, species and subspecies names retained by the three main classifications used in modern ornithology, i.e. Peters et al. (1931-1987), Sibley & Monroe (1990-1993) and Howard & Moore (1980-1994), are also defined in the database and linked with the original names. Additionally, suprageneric categories and many synonyms of different taxonomic levels were included in the database. English and French common names and geographical distributions are also recorded therein.

In conclusion I show how a taxonomic referential can be used to computerize a collection and how it plays a vital part in assembling type data.

Key words. Taxonomic referential, avian types, comparative systematic, ornithological collections, collection management

1. INTRODUCTION

The base line of any taxonomy is the 10th edition of Systema Naturae by Linné (1758). The publishing year of this work, 1758, or even more accurately, 1st January 1758, is considered to be the point „zero" of zoological nomenclature by article 3.1. of the International Code of Zoological Nomenclature (ICZN 1999). From then onwards, any new name of a bird species or subspecies published in a book or journal in the standard form of a Linnean binomen or trinomen is regarded as a valid contribution to nomenclature.

A collection of such published scientific names associated with their references is called a 'taxonomic referential'. Meanwhile, the number of animals known to science has become very large and hence there is a demand to manage the huge set of names and bibliographic references with computers. I have commenced the task of creating such a taxonomic referential for the class of birds (Aves) in form of a database.

2. MATERIAL AND METHOD

My computerized taxonomic referential is based on a relational database invented in the 1970s (Codd 1970). The key structural element of a relational database is that any information is stored only once in the whole system. Avoiding any duplications minimizes the size of such a database and allows quick and easy adjustments in the case of errors or taxonomic revisions. In doing this, links among data follow the logical structure of the scientific approach. I used the database management system 4D (www.4d.fr/) on MAC OS 9.

3. THE DATABASE AS A TOOL IN ORNITHOLOGICAL TAXONOMY

The taxonomic referential consists of three main traits. Firstly, there are three tables for names of genera (genus by original designation), species and subspecies (top of fig. 1), secondly tables for the references of each taxon (bottom row) and lastly tables for the author(s) of each taxon (middle row).

Each species or subspecies in the table TAXA is brought in relation by an identifier ('pointer') joining the following tables: (1) its current genus stored in a table of GENERA NAMES and (2) its current species name and, if existing, its subspecies name (might be the same name(s) as in the table 'TAXA', if the taxon is not considered to be a synonym), both stored in a table SPECIES & SUBSPECIES NAMES. It is further connected (3) with a table for its first and subsequent authors stored in a table of authors (AUTHORS TAXA) and lastly with its references in a table of references of taxa (REFERENCES TAXA). There might be more than one reference linked as a taxon that may have been described or discussed in several different publications even though only the first, the oldest reference, is important in terms of priority.

The same scheme has been followed for generic names. Each genus name of the table GENERA NAMES is related to the tables AUTHORS and REFERENCES by the table AUTHORS GENERA and the table REFERENCES GENERA.

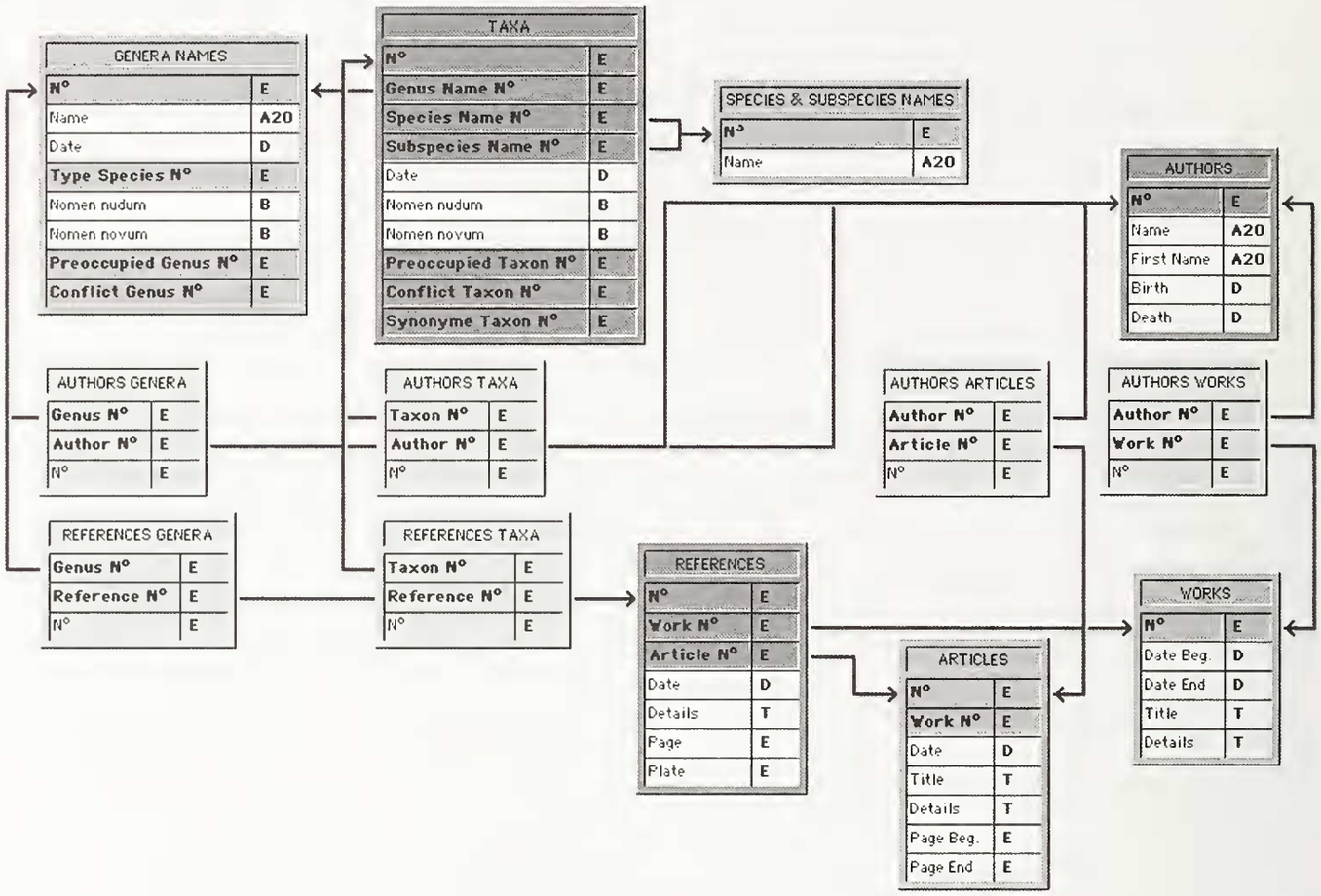

Fig. 1: Structure of the taxonomic referential with three major traits: upper row: names of genera, species and subspecies, middle row: authors of genera, species and subspecies, lower row: references.

Each reference is listed in context to the medium it was published in. Books are entered in the table WORKS related to all their authors and editors (table AUTHORS) by the table AUTHORS WORKS. If the publication medium is a journal, a full quotation of the reference also includes an article stored in the table ARTICLES related to its own authors through the table AUTHORS ARTICLES.

Thirteen tables are needed to store the taxonomic referential. This can be seen as a look-up table of avian names, consisting so far of approx 40,000 original designations of avian species and subspecies which were supposed new to science, published in approx 10,000 scientific papers by about 2,000 authors in about 1,400 different books and journals. All these Linnean bi- or tri-nomina include about 17,000 species or/and subspecies and 7,000 generic names.

Obviously, all taxonomical rules have been taken into account. Therefore the database distinguishes nomina nuda and nomina nova. In the latter case, where a newly established name replaces a preoccupied name, the database has to use two identifiers ('pointers') connecting the old with the new name.

For all genus names the type species (if known) may be stored in the table TAXA.

4. THE DATABASE AS A TOOL IN COMPARATIVE SYSTEMATICS

Due to the continuous growth of ornithological knowledge, avian names have changed significantly in different classifications over time. Furthermore, some of the original descriptions were considered to be of no relevance to modern systematics and their names subsequently became synonyms.

Nowadays, three main classifications are commonly used by ornithologists. The classification of James Lee PETERS et al. (1931-1986, JLP) has been generally adopted by museums for arranging their collections. The first classification partially based on DNA analysis, the work of SIBLEY & MONROE (1990-1993, SM), although often criticized, has become a major reference, mostly in biomolecular studies. Finally, the check-list of HOWARD & MOORE (1980-1994, HM) provides a modern update of PETERS' classification.

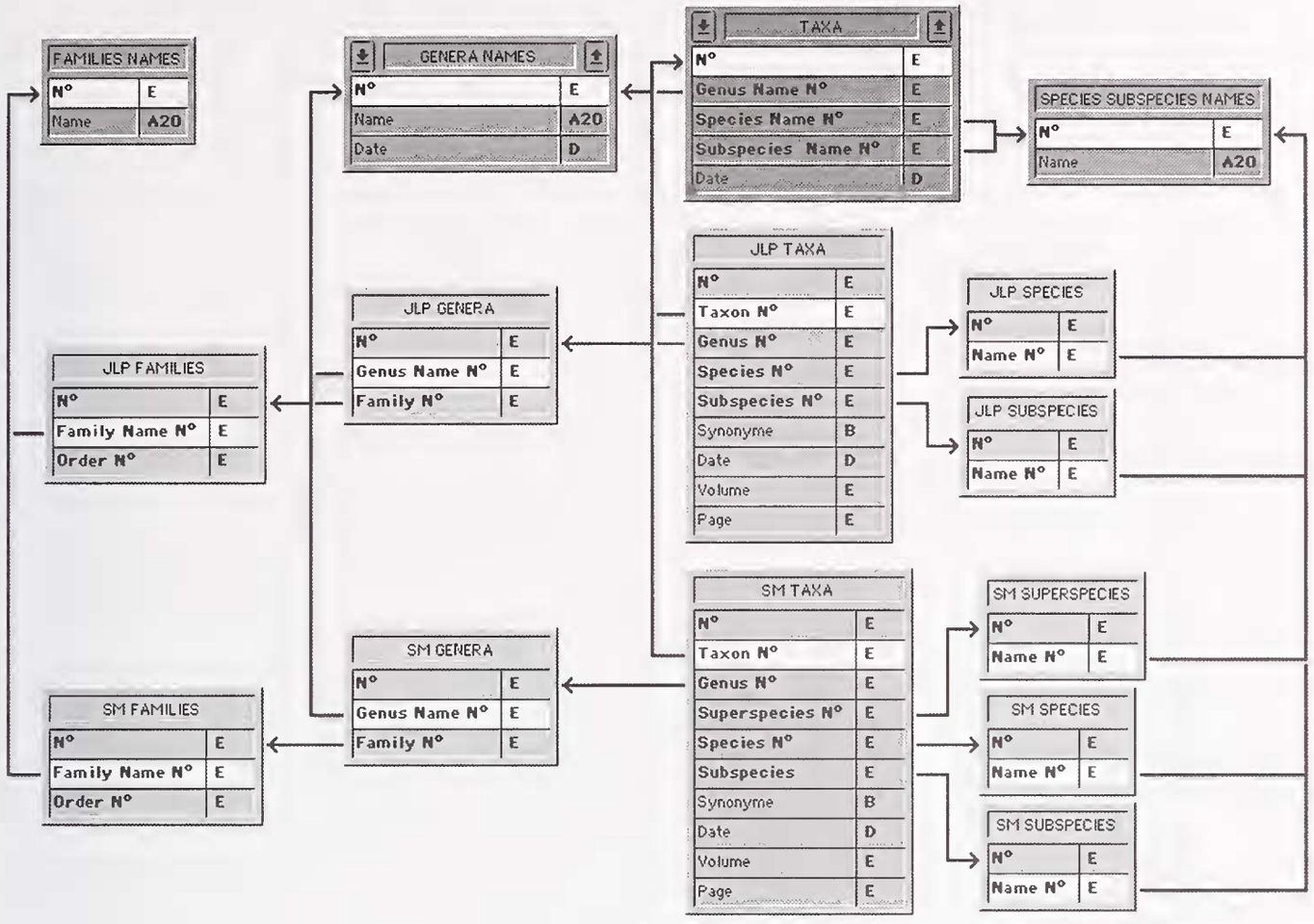

Fig. 2: Structure of the table comparing the classifications of SIBLEY & MONROE (bottom row) with PETERS' Checklist (middle row).

Any classification reflects the personal knowledge and views of its author(s), thus changing names from one classification to the other. Therefore I have created a table comparing the same taxon (species or subspecies) among the tree major classifications mentioned above.

Fig.2 shows the basic structure which enables my database to compare different classifications. At the top right corner, one finds again the previously defined table TAXA with its two companion tables GENERA NAMES and SPECIES & SUBSPECIES NAMES. In the middle row follow the corresponding tables of names used in PETERS' classification (JLP). Each name of a species/subspecies of JLP is brought in relation with a name of the original table of species/subspecies as well as with JLP's generic names. The latter must be present in the table GENERA NAMES.

This „standard set" can be seen as the taxonomic referential's dictionary of names. The classification of SIBLEY & MONROE (SM), tables shown at the bottom of fig. 2, with a supplementary table for the superspecific names, are fed into the database in the same way. All higher taxonomical levels of SM, i.e. subfamilies, tribes, families, orders, etc., are also entered as shown on the left of fig. 2 (here for families). Last but not least, HOWARD & MOORE (HM) is combined with the same links to the rest of the database. In future, further classifications like WOLTERS (1975-1982) and SHARPE et al. (1874-1898) can be added in the same way.

Table 1 gives a summary of the contents entered into the database so far. The specific qualities of each classification are shown in bold. The numbers of genera and subgenera given in parentheses include synonyms. The two numbers given in parentheses in the subspecies category are the totals of nominal subspecies and non-nominal subspecies, respectively. WOLTERS' classification is left in the table with some question marks, as this information has not been obtained yet.

In this taxonomic referential, common English names and geographical distributions follow SIBLEY & MONROE (1990). French names are from The International

CLASSIFICATION	J. L. PETERS et al.	H. E. WOLTERS	SIBLEY & MONROE	Howard & Moore
Dates	1931-1986	1975-1982	1990-1993	1990-1994
Authors & Date of Taxa	**YES**	**YES**	**YES**	NO
References	**YES**	NO	NO	NO
Orders	25	**51**	23	27
Families	164	**236**	147	172
Subfamilies	123	**175**	81	81
Tribes	7	**59**	0	0
Genera	**2,129 (4,434)**	**2,669 (4,228)**	2,064	2,018
Subgenera	149 (164)	**1,757 (2,691)**	0	0
Superspecies	0	0	**1,451**	0
Species	8,897	?	**9,702**	**9,359**
Subspecies	**22,217** (4,928 + 17,289)	?	2,115 (910+1,205)	**22,589** (5,061+17,528)
Synonymes	**8,714**	?	67	0
Type localities	YES	NO	NO	NO
Distribution	YES	YES	YES	YES
Common names	NO	German+English	English	English
Genera nova	1	15	0	0
Nomina nova	38	2	0	0

Table 1: The number of genera, species, subspecies and other peculiarities in the main classifications.

Commission on French Names of Birds (DEVILLERS & OUELLET 1993).

A query interface offers the following query options:
– name or part of a name of any taxonomical category,
– name or part of a name of authors,
– year or time interval of publications,
– name of publishing organ (book or journal)

Queries can be made in a specified classification or across all classifications. Synonyms of names can also be requested.

Fig. 3 shows an example of the database's output after a query for the following information on all classifications: generic name begins with „an" and species name with „rubr".

The output table is entitled by the total account for the particular query. In the above mentioned case seven possibilities of 41,373 entries fit the criteria (five are presented). Each taxon fulfilling the search criteria is given under its original designation as well as under its corresponding name in each classification, including its publication reference.

5. TAXONOMIC REFERENTIAL FOR MANAGING COLLECTIONS AND TYPES

The dictionary of names, which is built up from the different publications entered, helps to find the names used in different publications, on specimen labels and in type lists and may also help to computerize avian collections.

Fig. 4 indicates a possible use of my taxonomic referential to computerize a collection. For illustrative purposes, all tables introduced above are merged into one table (TAXONOMIC REFERENTIAL) shown at centre left of fig. 4. The table SPECIMENS on the right side represents the collection of the Muséum National d'Histoire Naturelle de Paris (MNHN).

Each record of the table SPECIMENS stands for a specimen of any kind (skin, skeleton, tissue, ...) registered under a collection number and collected at a given date and place (table LOCALITIES) by one or several collectors. Each specimen is brought in relation with a name found in any of the classifications of my database by the table IDENTIFICATIONS. This table is necessary to store the successive identifications made by further ornithologists who have been working on the particular specimen at different times. One additional table is linked into the identification table: that of the

Taxa : 7 sur 41373

Classification	Genus	Subgenus / Superspecies	Species	Subspecies	Author(s)	Day	Month	Year
	Anas		obscura		Gmelin			1789
J. L. Peters	Anas		rubripes		Brewster		Synonyme	1902
Publication name			Details of reference		Plates	Pages		
Systema Naturae, Editio decima tertia			Tomus 1			541		
	Anas		rubrirostris		Vieillot			1816
J. L. Peters	Anas		bahamensis	rubrirostris	Vieillot			
Howard & Moore	Anas		bahamensis	rubrirostris				
Publication name			Details of reference		Plates	Pages		
Nouv. Dict. Hist. Nat., nouv. éd.			vol. 5			108		
	Ploceus	(Hyphanthornis)	rubriceps		Sundevall			1850
J. L. Peters	Malimbus		rubriceps	rubriceps	(Sundevall)			
Sibley & Monroe	Anaplectes		rubriceps	rubriceps	(Sundevall)			
Howard & Moore	Anaplectes		melanotis	rubriceps				
Publication name			Details of reference		Plates	Pages		
Öfv. K. Vetensk.-Akad. Förhandl.			vol. 7			97		
	Ploceus		leuconotos		S. Müller			1851
J. L. Peters	Malimbus		rubriceps	leuconotus	(S. Müller)			
Sibley & Monroe	Anaplectes		rubriceps	leuconotus	(S. Müller)			
Publication name			Details of reference		Plates	Pages		
Naumannia			Erster Band, Viertes Heft			28		
	Anas		obscura	rubripes	Brewster			1902
J. L. Peters	Anas		rubripes		Brewster			
Sibley & Monroe	Anas		rubripes		Brewster			
Howard & Moore	Anas		rubripes					
Publication name			Details of reference		Plates	Pages		
Auk			vol. 19			184		

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Fig. 3: Output of an exemplary search.

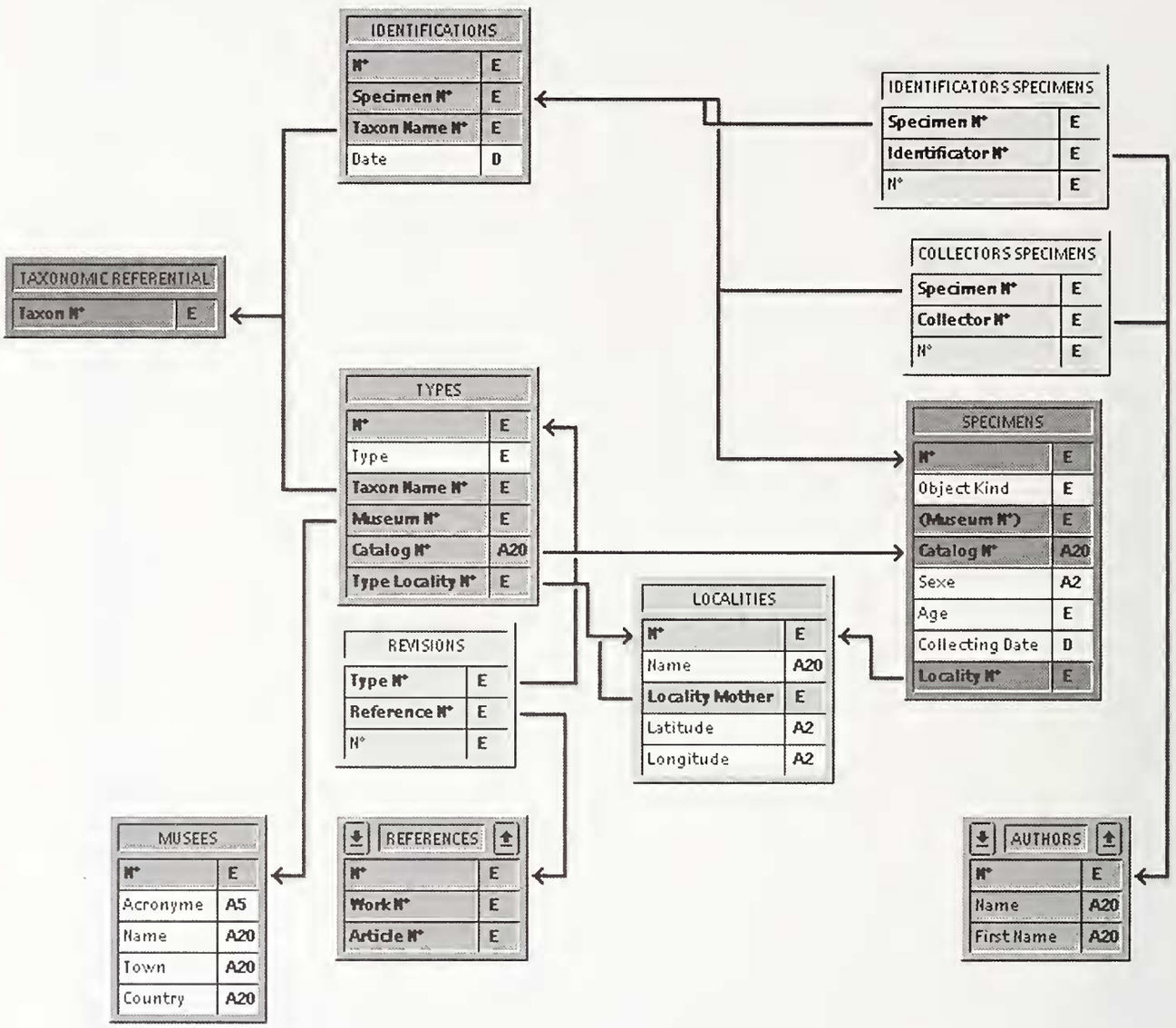

Fig. 4: Taxonomic referential: managing collections and types.

names of scientists identifying the specimen (table IDENTIFICATORS). Collectors of specimens and persons that identified speeimens are stored in separate tables linked to the table AUTHORS.

I have added another table to my database, the table TYPES. Each record of this table is joined – by definition – with a taxon name (table TAXA), which obviously should exist in the taxonomic referential. Further information, which would be wanted for each type, is the correct type status (neo-, lecto-, syn- and holotype, perhaps also para-, paralectotype), the LOCALITY where it was collected (terra typica), the name of the type-holding institution (MUSEES) and a eatalogue/register number. If additional papers quote further information on a type and if these papers are already entered in the 'REFERENCES' table, then these papers might also be cross-linked to the former table (REVISIONS).

About 500 types from the MNHN, and more than 7,000 types from the Natural History Museum, Tring, NHM, are already listed in my database. The unique combination of register/catalogue numbers of each specimen with the internationally accepted acronym of each museum forms a code which would facilitate any connections between single specimens of numerous museums' databases world-wide. This uniqueness of each entry of my database, combined with possible digital photos, would make it possible in the near future to construct a virtual, international, ornithological museum via the internet. Each institution sharing their databases with my database would have free access to this resource.